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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/531,831	04/18/2005	Seong Ho Yoon	LNK-0109	3754

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EXAMINER	
ZIMMER, ANTHONY J	
ART UNIT	PAPER NUMBER
4116	

MAIL DATE	DELIVERY MODE
11/27/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/531,831	HO YOON ET AL.	
	Examiner	Art Unit	
	Anthony J. Zimmer	4116	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 April 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-16* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-16* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *18 April 2005* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *4/18/2005*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Status

1. Claims 1-16 are pending and subject to examination.

Information Disclosure Statement

2. The information disclosure statement (IDS) submitted on 18 October 2007 is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Priority

3. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Drawings

4. The drawings are objected to because it is impossible to make out the figures in the drawings. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as “amended.” If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where

necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

7. Claims 1-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Baker et al. (US2002/0054849, hereafter D1).

In regard to claims 3 and 4, D1 teaches heating, in the presence of a carbon containing gas (catalytic pyrolysis), a catalyst bulk metal in powder form that had been reduced in hydrogen gas therefore forming a reduced catalyst. Though D1 does not specifically mention that hydrogen simultaneously forms very fine particles of the catalyst and reduces the catalyst, since the method steps leading to this result are the same (reducing the catalyst in hydrogen), the result produced by the method steps (forming very fine particles) would necessarily be the same. It is also specified in D1 that the catalyst particle size [after preparation] is 0.25 nanometers – 5 micrometers (a very fine particulate). See D1, paragraphs [0021] – [0023].

In regard to claims 5 and 6 (which depend on claims 3 and 4, respectively), D1 teaches using iron (Fe) as a primary metal and copper or nickel as a secondary metal in proportions of iron to the other metal of from 1% - 99%. See paragraph [0020] and Example 4 in D1. D1 also teaches reacting the catalyst at temperatures of from 450°C-700°C, see paragraph [0021] and Example 1; reacting for various times including 2 hours, 2.5 hours, and 1 hour, see Examples 1-7; and hydrocarbon/hydrogen gas mixtures containing from 20%-80% hydrogen, see examples 2 and 3. D1 does teach regulating the gas flow rate, see paragraph [0030] lines 4-5, but D1 does not mention a specific gas flow

rate of from 0.5-30 sccm/mg catalyst. However, it is common knowledge in the art that the gas flow rate is of critical importance during a gas phase reaction and that in order to form a product a sufficient amount of gas must be used (as it is a required reactant). The range of gas flow rates presented does not produce an unexpected result and is the result of routine optimization well within the level of ordinary skill. Therefore the range of flow rates from 0.5-30 sccm/mg catalyst does not impart a patentable distinction.

In regard to claims 7 and 8 (which depend on claims 5 and 6, respectively), D1 teaches using iron (Fe) as a primary metal and copper or nickel as a secondary metal in proportions from 1% - 99%. See paragraph [0020] and Example 4 in D1.

In regard to claims 11-13, D1 teaches heating, in the presence of a carbon containing gas (catalytic pyrolysis), a catalyst with iron (Fe) as a primary metal and copper or nickel as a secondary metal in ratios of iron to the other meal of from 1% - 99%. See paragraph [0020] and Example 4 in D1. D1 also teaches reacting the catalyst at temperatures of from 450°C-700°C, see paragraph [0021] and Example 1; reacting for various times including 2 hours, 2.5 hours, and 1 hour, see Examples 1-7; and CO/hydrogen gas mixtures containing from 20%-80% hydrogen, see examples 2 and 3. D1 does teach regulating the gas flow rate, see

paragraph [0030] lines 4-5, but D1 does not mention a specific gas flow rate of from 0.5-30 sccm/mg catalyst. However, it is common knowledge in the art that the gas flow rate is of critical importance during a gas phase reaction and that in order to form a product a sufficient amount of gas must be used (as it is a required reactant). The range of gas flow rates presented does not produce an unexpected result and is the result of routine optimization well within the level of ordinary skill. Therefore the range of flow rates from 0.5-30 sccm/mg catalyst does not impart a patentable distinction.

In regard to claims 14-16 (which depend on claims 11-13 respectively), D1 teaches using ratios of nickel to iron of 1:99 – 99:1. See D1 paragraph [0021].

(Also in regard to claims 11-16, it is established in the art to use iron in combination with other metals such as molybdenum and manganese: see US2002/131910.)

In regard to claim 1, in general chemistry, it has been well known that all carbon nanostructures are composed of hexagonal carbon planes. See PTO-892: evidentiary document US5653951 column 4, lines 37-38.
D1 teaches spacing between graphite sheets of 0.335 nm – 1.1 nm. See D1 paragraph [0019]. D1 also inherently teaches at least one growing

axis, as a nanofiber necessarily has to grow in at least one direction. Though the other limitations of claim 1 are not explicitly taught in D1, the process of making the product in claim 1 as disclosed in claims 3, 5, 7, 11, and 14 is substantially similar to the process as taught in D1 (see claims 3, 5, 7, 11, and 14 rejections above), therefore the products of these two processes would be substantially similar.

[Even furthering this conclusion, many angles between the carbon planes and the length direction of the fiber and the fact that the angle depends on the catalyst used are known in the art, and D1 shows this in Figure 1 (notice the various angles produced) and Example 6, Table VI (notice the various structures characterized by various angles in Figure 1 formed with different catalysts). Furthermore, nodes and knots including ones that periodically connect two fibers are a common defect in the formation of carbon nanostructures. See evidentiary documents: Figure 2 of US6456256 and Figure 5 of US6333016. As discussed above, there is also no difference between the process(es) of making the product of claim 1 as disclosed in claims 3, 5, 7, 11, and 14 and the process taught in D1 that suggests the formation of an unexpected, different product. The claimed product is a description of the product of a known process with a common defect.]

In regard to claim 2, D1 teaches spacing between graphite sheets of 0.335 nm – 1.1 nm. See D1 paragraph [0019]. D1 also inherently teaches at

least one growing axis, as a nanofiber necessarily has to grow in at least one direction. Though the other limitations of claim 2 are not explicitly taught in D1, the process of making the product in claim 2 as disclosed in claims 4, 6, and 8 is substantially similar to the process as taught in D1 (see claims 4, 6, and 8 rejections above), therefore the products of these two processes would be substantially similar.

[Even furthering this conclusion, nodes and knots are a common defect in the formation of carbon nanostructures which necessarily involve "inter-fiber" force or Van der Walls force since carbon molecules are involved on a molecular level and Van der Walls forces are inevitable due to constant electron motion. See evidentiary documents: Figure 2 of US6456256 and Figure 5 of US6333016. As discussed above, there is also no difference between the process(es) of making the product of claim 2 as disclosed in claims 4, 6, and 8 and the process taught in D1 that suggests the formation of an unexpected, different product. The claimed product is a description of the product of a known process with a common defect.]

In regard to claim 9, D1 also inherently teaches at least one growing axis, as a nanofiber necessarily has to grow in at least one direction. Though the other limitations of claim 9 are not explicitly taught in D1, the process of making the product in claim 9 as disclosed in claims 12 and 15 is substantially similar to the process as taught in D1 (see claims 12 and 15

rejections above), therefore the products of these two processes would be substantially similar.

[Even furthering this conclusion, knots including periodic knots are a common defect in the formation of carbon nanostructures. See evidentiary documents: Figure 2 of US6456256 and Figure 5 of US6333016. As discussed above, there is also no difference between the process(es) of making the product of claim 9 as disclosed in claims 12 and 15 and the process taught in D1 that suggests the formation of an unexpected, different product. The claimed product is a description of the product of a known process with a common defect.]

In regard to claim 10, D1 also inherently teaches at least one growing axis, as a nanofiber necessarily has to grow in at least one direction. Though the other limitations of claim 10 are not explicitly taught in D1, the process of making the product in claim 10 as disclosed in claims 13 and 16 is substantially similar to the process as taught in D1 (see claims 13 and 16 rejections above), therefore the products of these two processes would be substantially similar.

[Even furthering this conclusion, the bonding of two or more carbon nanofibers is a common defect in the formation of carbon nanostructures. See evidentiary documents: Figure 2 of US6456256 and Figure 5 of US6333016. As discussed above, there is also no difference between the process(es) of making the product of claim 10 as disclosed in claims 13

and 16 and the process taught in D1 that suggests the formation of an unexpected, different product. The claimed product is a description of the product of a known process with a common defect.]

Conclusion

8. In sum, all claims are rejected, and no claim is allowed.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anthony J. Zimmer whose telephone number is 571-270-3591. The examiner can normally be reached on Monday - Friday 7:30 AM - 5:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vickie Kim can be reached on 571-272-0579. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

ajz

/Vickie Kim/
Supervisory Patent Examiner, Art Unit 4116